IMPACT OF PILATES ON LUMBO-PELVIC STABILITY, NEUROCOGNITIVE ASPECTS AND SEVERITY OF AUTISM

SHORT SYNOPSIS

Submitted in partial fulfillment of the requirement of the degree of

DOCTOR OF PHILOSOPHY

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by

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Registration number: 20/Ph.D/006

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Abstract:

Background: Autism, a disorder marked by behavioral symptoms associated with a particular interest that impact higher brain functioning as well as lifelong socialization, language, communication, and a variety of other events. Physical activity has been demonstrated to enhance symptomatology and decrease comorbidities in individuals with Autism. Furthermore, there is yet no consensus on which exercise intervention paradigm is best for Autistic children. However, it is still unknown how to examine the elements in Autism using mind-body exercises like Pilates.

Objectives: This study's objective is to evaluate Pilates impact on lumbo-pelvic stability, Neurocognitive aspects and severity of Autism.

Methodology: There will be two experimental groups in this pre- and post-test study setup. A total of 44 individuals will be chosen in accordance with the inclusion and exclusion criteria and divided into two groups (n = 22) based on the low and moderate scores on the Childhood Autism Rating Scale. Pilates instruction will be provided to them for eight weeks, three days per week. A Pilates lesson will start with a warm-up, then include Pilates exercises and a cool-down. Before and after the eight weeks of pilates training, pre-test and post-test outcome measurements will be collected.

Expected outcome: We anticipate that children with autism will benefit from the pilates exercise by improving their lumbo-pelvic stability, neurocognitive aspects and their severity.

Key words: Autism, Pilates, Physical activity, Lumbo-pelvic stability, Neurocognitive aspects, Severity

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Certificate

I hereby declare that the short synopsis "IMPACT OF PILATES ON LUMBO-PELVIC STABILITY, NEUROCOGNITIVE ASPECTS AND SEVERITY OF AUTISM" being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in Physiotherapy under Faculty of Allied Health Sciences of Manav Rachna International Institute of Research & Studies, Faridabad during the academic year 2020. It is a bonafide record of original work carried out under the supervision of Prof. (Dr.) Moattar Raza Rizvi and has not been submitted in full or part to any other university or institute for degree or diploma. Further, it is certified that short synopsis is plagiarism free and proof has been submitted.

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Introduction:

Autism is a disorder distinguished by behavioral symptoms correlated with a specific interest that influence higher brain functioning as well as persistent socialization, language, communication, and a variety of alternate activities (R. Nazim Saracoglu et al., 2016).

The incidence estimate of children with autism is 1/59, aligning to the Centers for Disease Control and Prevention's statistics (Jinfeng Huang et al., 2020).

The inabilities to speak, use language, and converse are the most critical features of autism. These symptoms lead to bad interactions between children and their environment, individuals, and peers, as well as a lack of communicative development. Adolescence pulls out some of a child's undeveloped speaking and language skills. Children's social and emotional development is greatly impacted by their inability to communicate (R. Nazim Saracoglu et al., 2016).

Autistic children are more susceptible to have impairments in motor abilities such as balance, postural stability, coordination problems, and motor dyspraxia (Ferreira JP, 2018).

Autism is also accompanied by issues with social cognition. Many people with Autism suffer from both social and intellectual disabilities (Tetsu Hirusawa, 2020). Ineffective executive function has been implicated to a numerous clinical disease defined by a lack of behavioral control, attention, and judgment (such as autism). Children's competence to comprehend when to apply knowledge and then act when it is desirable may be regulated by executive functions. A child who cannot consistently organize, update working memory, transition from one mental set to another, or stop impulsive behavior in the classroom is unlikely to stay on course and achieve academically (Phillip D. Tomporowski et al., 2008).

Physical exercise induces morphological and utilitarian transitions in the brain, leading to substantial organic and mental consequences, according to several experimental and clinical research. Physical activity has been exhibited in repeated testing to avert cognitive abstain analogous with ageing, diminish the endanger of dementia, boost executive affair, and enhance comprehensive element of life. Physical exercise also causes variations in metabolic networks associated to cognition, according to research employing positron emission tomography. Physical activity has been reported to improve cognitive function across the lifespan, from youth to old age. Attention and cognitive flexibility have been linked to cognitive skills that are most reliant on brain maturity, suggesting that these two cognitive processes are interrelated. (Mandolesi et al., 2018).

In people with Autism Spectrum Disorder, physical activity has been used to improve symptom intensity and reduce comorbidities. Nonetheless, there is yet no unanimity on which exercise intervention strategy is ideal for children with Autism. Physical activity is essential for mitigating cognitive decline because it generates constitutional and functional transitions in the brain that have substantial organic and imaginary consequences. Adults may gain from physical-training schedules established on mind-body activities to prevent cognitive decline (Patricia Alexandra Garcia-Garro et al., 2020). However, it is still uncertain how to evaluate the

components in Autism employing mind-body exercises like Pilates. Various experimental and clinical research have been conducted.

The implementation of Pilates is not only as a healthy regimen for the individuals, but also as a curative approach, due to its well-documented efficiency. Overall, Pilates was shown to be an appropriate and efficient movement-based therapeutic technique, owing to its individual adjustability and the safety of its exercises (Lilly Meikis et al., 2021).

Breathing, cervical positioning, stabilization of rib and scapula, movability of pelvis, and engaging the transverses abdominis are the foundations of all Pilates exercises. Individual training develops the core muscles, which include the paraspinal, gluteal, and abdominal muscles in unique ways, and results in a controlled range of motion. Pilates anchors on the mass worthwhile effective enrollment of motor units, highlighting energy competency and conduct dominance. Your inherent body weight is the major source of resistance in the Pilates exercises. The added psychological component of Pilates can be seen in the increased emphasis on breathing and concentration during these movements (J. Kloubec, 2011).

Pilates is a core-stability training programme that employs neuromuscular organisation to regulate and protect the foundation body or spine. Pilates is a whole-body retraining programme that blends core strengthening exercises with mind and breath control difficulties offered by whole-body streaming. Pilates basis is on activity of core body and control of breath to activate the core muscles. Inclusion of core muscles helps to stabilize the lumbo-pelvic area. According to research, the Pilates method can be utilized as a supplementary workout plan to promote trunk and pelvic region control and mobility (S. Phrompaet et al., 2010). However, it may be reasonable to assume that Autistic children who can do functional tasks such as standing and walking still need to improve postural and lumbo-pelvic stability, as well as other components required for regulated movements.

Statement of Problem:

- It has been identified that Pilates has its effects on physical as well as mental health of individuals.
- There is lack of research pointing to the role of Pilates on lumbo-pelvic stability, social maturity, cognitive impairment and severity of Autism. A previous study established the effect of Pilates on performance Wechsler's acid profiles in children with learning disabilities. There isn't enough data to conclusively demonstrate Pilates' impact on autistic traits.

Aim of the study:

The aim of this research is to determine the impact of Pilates on lumbo-pelvic stability, social maturity, cognitive impairment and severity of Autism.

Objectives of the study:

- To measure the Pilates impact on lumbo- pelvic stability in children with autism.
- To measure the effect of Pilates on social maturity, cognitive impairment (neurocognitive aspects) in children with autism.
- To measure the effect of Pilates on severity of Autistic children.

Research Hypothesis:

- Pilates will have a statistically substantial impact on autistic children's lumbo-pelvic stability.
- Pilates will have a statistically substantial impact on autistic children's social maturity and cognitive impairment (neurocognitive aspects).
- Pilates will have a statistically substantial impact on autistic children's severity.

Null Hypothesis:

- Pilates will not have a statistically substantial impact on autistic children's lumbo-pelvic stability.
- Pilates will not have a statistically substantial impact on autistic children's social maturity and cognitive impairment (neurocognitive aspects).

- Pilates will not have a statistically substantial impact on autistic children's severity.

Operational Definitions:

- Autism: Autism is a disorder characterized by behavioral symptoms associated with a specific interest that impact higher brain functioning as well as socialization for lifetime, language, communication, and a variety of else activities (R. Nazim Saracoglu et al., 2016).
- Pilates: Pilates training, given by Joseph Pilates, has a basis on spine neutrality management exercise training, is particularly beneficial in restoring physical task such as balance, flexibility, and so on. (Yun Seok-Min et al., 2017).

Review of Literature:

Autistic individuals suffer symbolic issues in social and communication, interest disorders with limitations and repetitive behaviours. Although the precise age restrictions have not been determined, it primarily affects children and adolescents. Motor skills are frequently hampered in autistic individuals, along with the basic afflictions of communication, social interaction, and stereotyped behavior. Many studies on the outcomes of physical pursuit on autistic children and adolescents are now underway. Physical exercise has been shown to have a clear intervention impact on autistic patients, and as core symptoms get better, so do the physical and mental health of autistic people. Physical activity has been demonstrated in certain studies to enhance all aspects of social interaction, stereotyped behavior, and athletic skills in autistic children and adolescents, potentially lowering the severity of autism (Jinfeng Huang et al., 2020). As a result, more research into the benefits of various types of physical activity is needed.

Relationship of Exercise on Cognitive Performance Aspects

Many studies have shown that physical activity affects brain plasticity, which influences cognition.

The organic effects of Physical Exercise allied to "neuroplasticity" are especially symbolic. The neural system's capacity to conform by its very nature in return to affair or episode is known as neuroplasticity. As a consequence, Physical Exercise could be marked an environmental integral that upholds neuroplasticity.

According to multiple studies, Physical Exercise promotes anatomical transformations in adults, like as elevated quantity of grey matter in the hippocampal and frontal areas and reduced wreckage of grey matter.

The brain receives "food" from blood flow and healthy cerebrovascular function, which are facilitated by physical exercise.

Cognitive functioning reflects these impressions. In reality, physical activity increases cognitive functioning in both young and older adults, involving memory, attention, and executive-control processes. Moreover, post-exercise structural changes are associated with school performance compared to inactivity (Mandolesi et al., 2018).

Impact of Pilates training on aspects of cognitive Performance

Pilates is a set of peculiar exercises that enhance overall strength and stamina while also targeting the body's deeper muscles by working on both the body and the mind.

Pilates employs six principles to help people improve their focus, motivation, and cognitive performance while also reducing physical stress. Pilates is a sort of moderate exercise that focuses on mental factors.

It is a cost-effective training paradigm for those who are undergoing rehabilitation therapies that are well-executed without the usage of additional equipment.

According to study, Pilates instruction may aid in the prevention of brain disorders and the recovery of cognitive issues (Seghatoleslamy et al., 2019).

Seghatoleslamy et al. did a study in 2019 to see if aerobics or Pilates activities may help children with learning difficulties improve their Wechsler acid profile performance. The findings revealed that a non-invasive strategy of 8 weeks of aerobics or Pilates workouts has a positive impact on performance of the Wechsler Acidity Profile subtest in children with learning disabilities.

However, evidence on the effectiveness of Pilates exercises in autistic children is limited and inconclusive.

Pilates training's effects on the lumbo-pelvic region's stability

The reformed method of Pilates is a complete body and mind workout programme that combines torso firmness, contemplation, respiring approach, and entire frame outcome. The pelvic floor muscles are activated during Pilates movements, which helps to reduce pelvic tilt. Contemporary provocation and co-diminution of torso core muscles, notably the transverse abdominus and multifidus in the spinal cord, improves lumbo-pelvic stability. This style of training includes low-intensity, long-term, and repeated movements that aim to improve trunk muscle strength, endurance, and neuromuscular control (Ahmadreza Asgari Ashtiani et al., 2020).

Methodology:

Study design

Experimental Study design using two test groups (pretest-posttest).

Study Place

SGT Hospital, Gurugram

Outcome Measures

Lumbo-pelvic stability :

- Pressure biofeedback

Social Maturity:

- Vineland Social Maturity Scale

Cognitive impairment:

- Trail Making Test (TMT) Parts A and B

Severity of Autism:

- Childhood Autism Rating Scale (CARS)

Inclusion criteria

1. Autistic children between 7-13 years of age (already diagnosed cases)
2. Those parents willing to enroll their child in the study
3. Children who are able to follow commands

Exclusion criteria

1. Presence of any severe learning disability
2. Presence of anxiety
3. Presence of depression
4. Presence of intellectual disability
5. Presence of visual and hearing impairment
6. Presence of any other disorder and intervention

Dependent Variable

- Pilates

Independent Variable

- Lumbo-pelvic stability
- Social Maturity
- Cognitive impairment
- Severity of Autism

Sample size: The calculation of the sample size was done using the software G. Power version 3.1.9.7 at power 0.85, α 0.14, and effect size 0.8, the sample size of 40 participants was found to be necessary to test the study hypothesis. Considering 10% dropouts, the sample size for the present study was found to be 44 participants (22 in each group).

Instrumentation

- Flat/Non-Slip surface
- Mat
- Pressure biofeedback
- Vineland Social Maturity Scale
- Trail Making Test (TMT) Parts A and B
- Childhood Autism Rating Scale

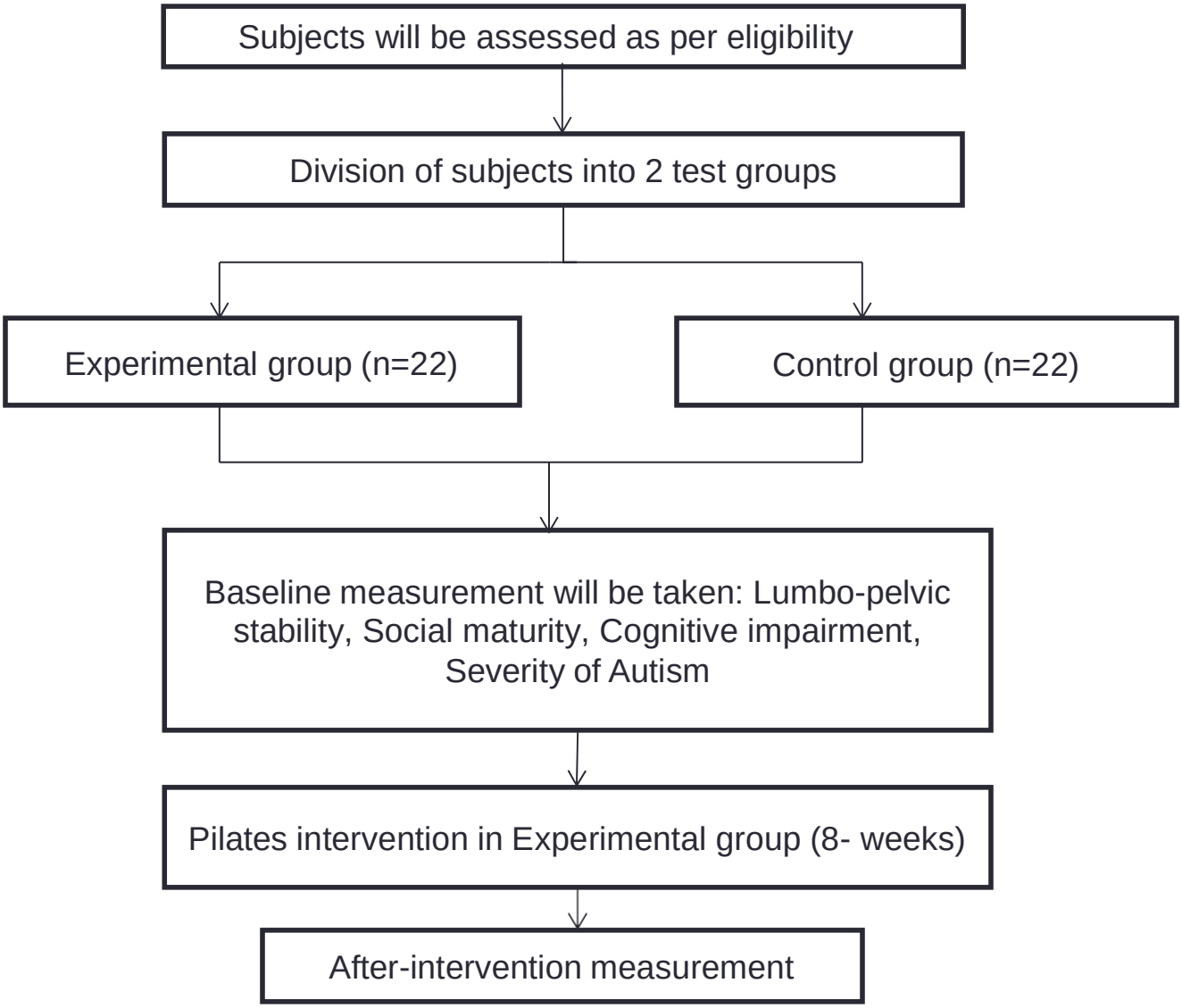
Subjects will be assessed as per eligibility
Division of subjects into 2 test groups
Experimental group (n=22)
Control group (n=22)
Baseline measurement will be taken: Lumbo-pelvic stability, Social maturity, Cognitive impairment, Severity of Autism
Pilates intervention in Experimental group (8- weeks)
After-intervention measurement

Fig 1: Flow chart of design of study

Procedure:

- Every subject will be briefed about the study and given written consent prior to enrollment in the study. Before starting the procedure, a pre-test measurement which includes lumbo-pelvic stability, social maturity, cognitive impairment and severity of Autism will be measured. After that, 8 weeks of Pilates training will be given to the subjects and estimation of the same will be taken after the test.

- **Intervention**: Subjects will undergo eight weeks of Pilates training. Pilates training will be provided thrice a week. Each workout includes general warm up exercises followed by Pilates training and cool down exercises. Warm up exercises includes stretching the whole body. Pilates training includes special training program including Pilates Exercises. Cool down exercises includes stretching exercises. (Familiarization sessions of Pilates training will be given to them 4-6 times to understand the protocol).

- After 8 weeks of Pilates training, outcome measures similar to pre-test measures will be obtained.

Outcome measures

Assessment of Lumbo-pelvic stability by Pressure Biofeedback Unit: Lumbo-pelvic stability will be evaluated by the pressure biofeedback machine. The testing procedure will be according to Harrington and Davies and Jull et al. At 0, 4, and 8 weeks of instruction, it will be reviewed. To place the spine in a mid-position, the subject will lie in a supine crook position with 70 degrees of hip flexion. Set up a barrier to limit leg mobility to 90 degrees of hip flexion at a minimum. Once the initial test leg has been chosen at random, the Pressure Biofeedback device will be inserted behind the lumbar spine from S1 to L1 and inflated to 40 mm Hg. For stability and balancing, place the resting leg on the weighing scales, making sure the subject isn't propelling through it (Richardson et al., 1992). Direct the subjects to take a few deep breaths in and out before continuing to hollow their abdomens throughout the remainder of the test (Hodges and Richardson, 1997b). A one-sided heel-lift will be performed in the sagittal plane, necessitating hip flexion from the initial spot (70 degrees), to the barrier (90 degrees), and back to 70 degrees with the knee in flexion (Leckie, 2001). A successful performance is defined as the potential to keep the inscribed pressure at 40 mm Hg (+,-2mm Hg) during the movement (Lee Herrington et al., 2005).

Assessment of Social Maturity by Vineland Social Maturity Scale: This scale will be used to evaluate the children's self-help abilities in the categories of general Self-help, self-dressing, self-help eating, self-determination, mobility, communication, employment, sociability. The scale produces social ages and social quotients that can be used to assess intelligence. The Stanford-Binet Intelligence Scale and this test show a correlation of 0.85 to 0.96 (Tabitha Louis P. et al., 2014).

Assessment of Cognitive impairment by Trail Making Test (TMT) Parts A and B: There are two components to this test: Part A and Part B. Visual search speed evaluation is covered in Part A. Part B assesses cognitive flexibility, divided attention, processing speed, and alternation (Ashendorf et al., 2008). In Part A, the candidate must as soon as possible—without removing the pencil from the paper—connect a series of numbers (ranging from 1 to 25) that have been randomly arranged on a page, in ascending order. The examinee must adhere to the identical directions in Part B, linking letters (A to L) and numbers (1–13) in ascending order that have been randomly organized. Each section of the test can be finished in 5 minutes by the test taker. The test should be stopped after this time frame. The execution of Parts A and B can be analyzed by taking into account the execution time (in seconds) and the number of mistakes (Fernanda Rasch Czermainski et al., 2014).

Assessment of Severity of Autism by Childhood Autism Rating Scale: This scale can reliably differentiate between autistic children and those with intellectual disabilities as well as between children with mild to moderate autism and those with severe autism. It includes 15 objects and is appropriate for children of all ages. The things are graded from 1-4 on the basis of firsthand observation. A score of one denotes age-appropriate behavior, whereas a score of four denotes significantly aberrant behavior. The total score, which ranges from 15 to 60, is equivalent for all items (Chakraborty et al., 2015).

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